

Small, Price Competitive 100-V Driver for 48-V BLDC Motor Drives

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BLDC motor drives with 48-V input are used in a variety of applications in the consumer, industrial, and automotive space. The motor drive power train typically consists of three half-bridge power trains to drive the three windings in the motor. These half-bridge power trains require a gate drive solution that can drive a floating high-side power switch. The solution used is typically an integrated three-phase motor driver if the power devices do not require high drive current. Alternatively, external control and three half-bridge drivers if higher drive current is required for larger power devices.

Common Half-Bridge Drive Solutions and Desirable Features for Low-Voltage BLDC Drives

External control and half-bridge drivers are commonly used in higher power motor drives. Many of the 600-V half-bridge drivers feature input interlock that prevents the driver high-side and low-side outputs from being on at the same time when both driver inputs are both high. Ground bounce from the control ground to driver and MOSFET source ground can result in noise spikes on the driver input signals. This feature adds robustness to the design as unexpected noise spikes on the driver inputs does not result in both power switches in the half-bridge being on at the same time, which results in cross-conduction of the power switches. Even though many 48-V or below BLDC motor drives may use power devices rated at 100 V or less, these existing 600-V half-bridge drivers are used for these reasons.

Enhanced Solution for Low-Voltage BLDC Drives

The LM5108 is a 100-V half-bridge driver that must be considered for 48-V BLDC drives. Refer to [Figure 1](#) for the simplified BLDC diagram.

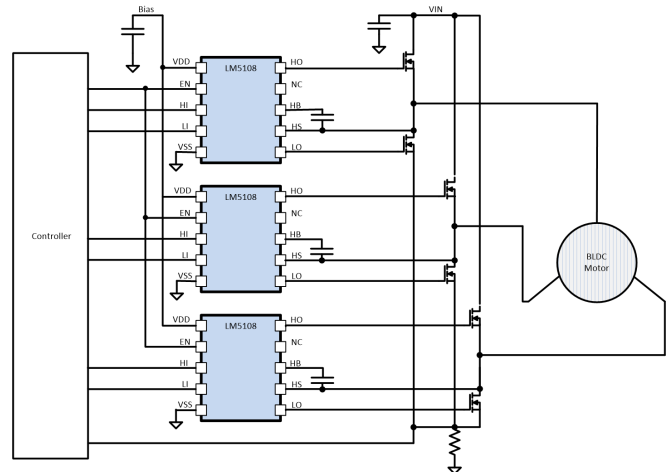


Figure 1. Simplified BLDC Drive with LM5108 Half-Bridge Driver

The LM5108 voltage ratings are adequate to work with motor drive power trains with 100-V-rated power devices. This 100-V driver includes the input interlock feature, which prevents cross conduction of the power switches. There are several advantages of the LM5108 over the typical 600-V half-bridge drivers. The package is a 3 mm x 3 mm SON, which is only 30% of the PCB area compared to the typical 600-V 5 mm x 6 mm SOIC-8 package. The LM5108 includes an internal bootstrap diode, which most 600-V drivers do not. This can save additional PCB space and reduce BOM cost. The LM5108 features an enable pin that sets the driver into a low-current standby of only 7 μ A. This may be important for battery-powered applications. The enable pin can be used to turn off the driver, and therefore the power train off, in case of fault conditions. This may be faster than a microcontroller, as many times the fault interrupt loop is significantly slower. The propagation delay of the LM5108 is 20-ns typical, which is much lower than the 100 ns to 200 ns of most 600-V legacy half-bridge drivers. Although the switching frequency is low in BLDC applications, the response to faults such as overcurrent are faster with the LM5108. The LM5108 package is a SON-10 with a power pad that has a much lower thermal resistance of 47.3 $^{\circ}$ C/W junction to ambient versus the typical SOIC-8 thermal resistance of approximately 100 $^{\circ}$ C/W. This may be an advantage in high ambient temperature operating conditions. Refer to [Table 1](#) for a comparison of the

LM5108 and typical 600-V half-bridge driver parameters. The LM5108 includes the input interlock feature, which is important to improve robustness, especially in high-noise environments. The interlock behavior is shown in Figure 2.

Table 1. LM5108 and 600-V Half-Bridge Driver Comparison

Device	Prop Delay, (ns)	I _Q Standby (uA)	R _{θJA} (°C/W)	Package Area (mm ²)
LM5108	20	7	47.3	9
600 V HB	150	180	100–200	30

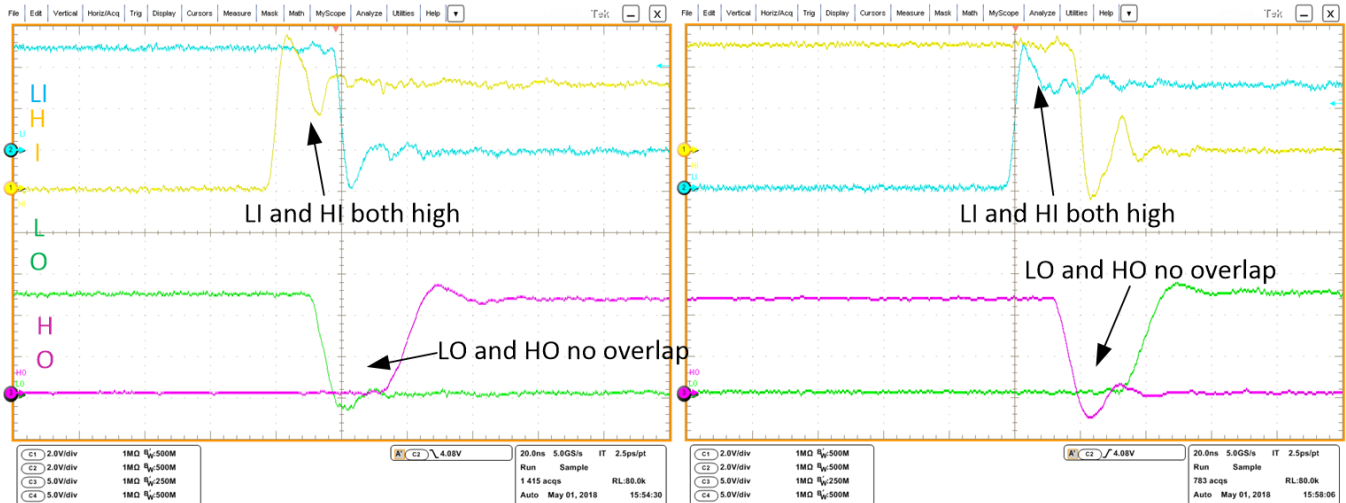


Figure 2. LO and HO with Overlapping LI and HI Inputs

The LM5108 offers improved performance over the typical 600-V half-bridge drivers for 48-V BLDC drives while keeping costs similar to existing 600-V solutions. Robustness is maintained with interlock protection, PCB space is reduced, thermal performance is improved, and standby current can be significantly reduced by utilizing the enable input.

Find out more information on the LM5108 at:

- ti.com/gatedrivers
- [LM5108 Product Page](#)
- Texas Instruments, [LM5108 Robust and Compact 100-V Half-Bridge Gate Driver Data Sheet](#)

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